THE INTERNATIONAL JOURNAL OF THE INSTITUTION OF FIRE ENGINEERS

Educational Supplement

REPORT ON IFE EXAMINATIONS 2001
Membership Examinations

Paper 1 - Fire Engineering Science

Question 1.1: *A dividing breeching has one inlet and two outlets all of which have a diameter of 70 millimetre. During a test it was found that the corresponding inlet and outlet pressures were 7.5 and 8 bars respectively. Treating friction losses as negligible and using Bernoulli's equation, determine the outlet velocity, then, calculate the flow rate of water through the breeching.*

This question was generally poorly answered by candidates who still haven't grasped the principals of the Bernoulli's equation. Bernoulli's equation gave the output velocity which then could be input into

$g = 2a \times V_2$ or alternatively $L = \frac{Vd^2}{21.2}$

which gave the required flow rate, which for revision purposes was 44.4 litres/second

Question 1.2: *Describe how toxic materials can enter and function as poisons within the body.*

This was a popular question and candidates generally did understand how toxic materials could enter the body which are:-

1. Inhalation
2. Ingestion
3. Through the skin

but then the majority of candidates struggled to answer how these function as poisons within the body, the answer the question asked for was

1. Irritants
2. Asphyxiants
3. Anaesthetics and Narcotics
4. Systematic poisons

Question 1.3: *Define and describe the nature, properties and hazards of three metals which are "pyrophoric".*

This was an unpopular question with only one third of candidates achieving a pass. Marks were to be easily gained by those who analysed and addressed the question. Pass marks were available for those who could describe in generic terms the nature, properties and hazards, although few candidates appeared to understand these concepts. Other candidates wasted time and effort and achieved no marks for describing metals in general, or describing the properties of radioactive materials. Better understanding of this area of chemistry is required to pass at Membership level and candidates are reminded to adequately prepare for this Science paper.

Question 1.4: *Describe the generation and distribution of electricity detailing in your answer an explanation of the principles of an electrical transformer.*

Candidates attempted this question with a degree of confidence and some excellent scores were achieved. The principals of generation and distribution of electricity, coupled with the functionality of transformers were understood by many candidates. Many candidates were awarded good marks for clear diagrams of a distribution network and a simple transformer. Marks were regularly awarded to the candidates who were aware that to distribute electricity, high voltage is required (current reduced) with the associated drop in resistance which results in less power loss.

Question 1.5: *Describe the processes of extinction which are thought to occur in the use of dry powder extinguishers.*

Candidates appeared not to understand the subject matter and reverted to answer the question drawing information from their own practical experience of the use of dry powder extinguishers.

Dry powders are thought to extinguish fires by both physical and chemical mechanisms, and when describing the chemical process, candidates all too often wrote down a variety of H_2 and O_2 which unfortunately bore no resemblance to the model answers.

Question 1.6: *Describe the essential feature of construction and by reference to behaviour in a fire, discuss the relative merits of the timber framed type of construction compared to that of the more traditional brick building.*

This question was poorly answered, the highest mark awarded was seven. Candidates obviously did not read and understand the question. Many texts described in detail the different elements of structure i.e. column beams etc. rather than the subject matter which was to compare timber framed to the more traditional brick constructor. Read the question several times and if unsure of the requirements ask the examination invigilator for advice.

Question 1.7: *The typical "time/temperature curve" describing a combustion reaction contains phases of ignition, growth, flashover, decay and extinction. Describe each phase in terms of the free radical mechanism of combustion.*

Most candidates were able to answer the parts of the question which pertained to the time/temperature curve and the Branching chain reaction. However, the section of the question which stated, "describe each phase in terms of the 'Free Radical' mechanism of combustion" was not understood by many candidates. Most candidates floundered by explaining this concept using common sense and general knowledge that at Membership level was not satisfactory.

Question 1.8: *a) Define the classification system used to control the use of electricity in flammable atmospheres; b) In an electrical circuit a particular piece of apparatus with a resistance of 24 ohms is used on a 240-volt supply for 10 seconds. If this were in a flammable atmosphere which requires 0.02 MJ of energy to ignite the mixture, show by calculation that an explosion may occur, and; c) How could the apparatus be adapted so it could be safely used within that environment?*

Candidates generally answered parts (a) and (b) very well and it was pleasing to see that more candidates are becoming comfortable with mathematical science based questions. Part (c) did not fare so well, the majority of candidates displayed little

knowledge and understanding of how to answer this part. A considerable number of candidates lost marks describing a variety of electrical topics hoping they could gain marks in the final analysis and failed to achieve any. Its not all bad news though, one candidate scored full marks. He had obviously prepared himself and had a confident understanding of the subject matter.

Question 1.9: *Describe the operating principles of heat detectors and discuss the advantages in their use.*

This was the most popular question, and candidates who displayed a detailed knowledge of operating principles and who had discussed advantages did very well from the generous marking scheme. Some candidates appeared not to comprehend the question's requirements and unfortunately described the operation of a bi-metallic strip. Put down bullet points and structure your answer.

Question 1.10: *Explain the three energy components of Bernoulli's equation. A pipe is 6 metre above a datum and carries water at a rate of 100 litre/second. The pipe diameter is 100 millimetre and the pressure in the water 200 KN/m^2. Calculate the energy content of the water: (Density of water = 1000 kilograms/m^3)*

Most candidates were aware and understood the energy components of Bernoulli's equation which are:

$\frac{V_1^2}{2}$ = is the kinetic energy compound

gh_1 = is the potential energy component and

$\frac{P_1}{\rho}$ = is the pressure energy component

Only one third of candidates, however, were able to progress and calculate the total energy with reference to a **single** datum. Utilising the information given, it was necessary to firstly calculate the area of the pipe:

$$P_1^2 \text{ or } \frac{P_1 d^2}{4}$$

then the velocity of the water flow:

$$Q = aV \text{ or } V = \frac{2l.2L}{d^2}$$

or:

$$v = \frac{20L}{d^2}$$

to substitute directly into the equation

$$E_T = \frac{V^2}{2} + gh_1 + \frac{P_1}{\rho}$$

And finally many candidates failed to gain easy marks by explaining the terms and units.

Paper 2 - Fire Safety

Question 2.1: *Discuss the reasons for installing sprinkler systems in domestic and residential properties.*

This was a popular question which unfortunately was not understood by the majority of candidates. Candidates all too frequently mis-read the question and submitted detailed scripts describing the mechanics of sprinkler systems. Some also used excellent diagrams to support their answers. Unfortunately despite these efforts no marks were awarded. Candidates are therefore reminded to read and understand the question and formulate a structured answer.

Question 2.2: *Increasing use is being made of the engineering approach to fire safety as an alternative to prescriptive fire safety code requirements. Explain the concept of fire engineering and the principle elements that comprise the engineering approach.*

This proved to be an unpopular question with candidates score reflecting their lack of knowledge regarding the concepts of fire engineering. At Membership level that is disappointing as this subject has been regularly aired for many years. Candidates indeed expressed little knowledge of the content of British D.D. 240, understandable for our overseas colleagues but not acceptable for the home candidates. Candidates who did have a good knowledge of BSDD240 unfortunately directed their answers describing the benefits of adopting an engineering approach. This was not asked for in the question.

Question 2.3: *Define 'Travel distance' as used in means of escape codes of practice and discuss the factors that influence the selection of travel distances suitable for the assumed occupancy of a building.*

The majority of candidates chose this question, and many scripts submitted attracted excellent scores. Candidates were comfortable with the first part of the question but generally their knowledge of travel distance in the second part was not consistent. Travel distances have been with us now for many years and candidates are reminded to, in future, be more familiar with their concepts.

Question 2.4: *Discuss in detail the advice you might give to the developer of a residential multi-storey block of flats on the provision of automatic fire detection aimed at providing an early warning to the occupants of a flat in which a fire might start, and an appropriate warning to the other residents of the building.*

Although many candidates generally displayed a broad knowledge of the subject there was one outstanding script submitted and many candidates therefore attained a pass mark. For revision purposes the following are some of the issues taken from the model answer:-

1. Smoke detection in common areas
2. Advice must be left for the occupiers on alarm usage and meaning of signalling
3. Manual call points must be vandal proof in common areas

Question 2.5: *Describe in detail the structural fire precautions necessary to secure patient safety in the event of fire in a large hospital. You are to assume that the evacuation of all parts of the hospital is impractical due to the medical condition of some of the patients.*

This was a popular question generally, unfortunately poorly answered. Some candidates, however, demonstrated a basic understanding of structural fire precautions when applied to a modern hospital. Candidates did on occasion submit extensive scripts discussing fire safety issues that were not attributed to "structural fire precautions" and therefore did not achieve any marks for their efforts. Few candidates seemed to understand the range and detail of structural fire precautions. The syllabus clearly refers to construction codes, and candidates should in future include these codes in their preparation for further examination.

Question 2.6: *Discuss how the behavioural aspects of people in fire should be used to plan the means of escape from a large departmental shopping store.*

The majority of candidates demonstrated a basic knowledge of the behaviour of people in fire, but few described this issue with sufficient depth of knowledge to attract a pass mark. The question clearly was related to the design of means of escape and candidates who included in their answers the influences of emergency lighting and fire alarm systems not only wasted

valuable examination time but also gained no marks. This has been a well documented issue for many years and candidates therefore will have to read and understand these reports, rather than just referring to them in their answers.

Question 2.7: *Discuss in detail the training of teaching staff in a large school in order to secure the safe evacuation of all pupils in the event of fire.*

This was the opportunity in this paper to score well, this question required a general knowledge approach to be adopted by candidates, and for many this was achieved and high marks were awarded. Bread and butter answers should have included the following from the model answer:-

1. Assembly points
2. Frequency of training
3. Re-entry into school, and
4. Taking the roll call

Question 2.8: *Discuss the need for, and design criteria of, an emergency lighting system for a factory building with offices. The factory area will remain in use 24 hours a day but the offices will be in use only between the hours of 9 am and 5 pm*

Unfortunately the majority of candidates failed to achieve a pass mark. Generally answers contained too little detail or alternatively candidates mis-read the question and directed their answers towards the advantages and value of emergency lighting, rather than discussing the design criteria of such a system. If candidates are to be successful especially at membership level they must read and understand the question requirement.

Paper 3 - Fire Protection Technology

Question 3.1: *Discuss the design implications of providing an automatic fire detection system intended to operate a smoke control system in a 10 storey atrium.*

With the exception of one candidate who achieved a score of 18 this question was generally poorly attempted with few candidates achieving a pass. The general concept of providing automatic detection in both confined and open areas would have achieved good marks. Candidates should consider general principles such as the effect on the buoyant smoke plume and the need to run point and beam type detectors in tandem for open spaces. The bibliography for UK candidates for this question is BS5839 Part 1 1988 and Design Methodologies for smoke and heat exhaust ventilation, BRE/FRS1999.

Question 3.2: *Discuss in detail the characteristics and properties regarded as essential for a good intumescent material.*

This proved an unpopular question with only a few candidates achieving a pass. Good marks were awarded to candidates who had read and understood the question and who had directed their answer towards the characteristics of intumescent material. The markers were looking for a combination of the following:-

1. Capability to react at high temperatures
2. Activate in a cohesive manner
3. Reaction to heat to be consistent

Some candidates lost marks when they spent time describing where intumescent materials should be installed rather than explaining their characteristics. Generally candidates required a better understanding of this material at Membership level.

Question 3.3: *Transmission delay units may be used to reduce the instances of false alarms of fire from alarm systems. a) Outline the normal sequence of events following operation of a fire alarm where a transmission delay unit has been fitted, and; b) Describe any restriction that should be applied to such systems*

This was a popular question and on this occasion was answered very well, some candidates achieved excellent pass marks. Candidates obtained very good marks when they demonstrated an in depth knowledge of time delays and restrictions that should apply to systems. Each of these areas was allocated 10 marks. It was pleasing to see some candidates submit scripts that followed a logical sequence, but the unfortunates lost marks by mis-interpreting the question and outlining the operation of home detectors.

Question 3.4: *Describe the minimum requirements (pressure and flow) for Ordinary Hazard classification sprinkler installations.*

This question was not understood by many candidates and often irrelevant information was offered with the resultant no marks awarded. The question clearly asked for a description of the basis for pressure and flow requirements for ordinary hazard installations, which for revision purposes can be found within BS5306 Part 2, Table 15, Page 53. However, many candidates preferred to give inappropriate answers. Good marks however were offered to those candidates who described the Sub-groups of sprinkler systems in this hazard group; candidates who recognised the need for allowances in pressure due to static pressure were awarded extra marks.

Question 3.5: *Describe how inert extinguishing agents work and discuss the factors that affect their efficiency.*

This question proved for some reason to favour the Institution's overseas candidates who demonstrated that they had understood the questions requirements and answered accordingly. Marks were awarded for answers that contained the following points:-

1. The removal of oxygen from the atmosphere
2. The inhibitory factor, and the
3. Effect of cooling and gas density.

Question 3.6: *In fixed gaseous extinguishing systems containing inert extinguishing agents, describe in detail the advantages of high pressure gas systems with a low mass volume flow and detail the precautions to be observed at the point of application.*

Candidates appeared not to grasp that the question required description of the advantages of high pressure gas systems. Many candidates directed their answers towards the physical characteristics and were awarded no marks for their efforts. For revision purposes the model answer can be found within the Fire Safety Engineering journal October 1999 Volume 6, Number 5.

Question 3.7: *In terms of explosion and suppression/protection systems, explain in detail the principles of operation for the following: (i) Flame arrestors/trap; (ii) Blow-off discs.*

This was generally a well answered question and some candidates attracted excellent marks. For those candidates who used sketches to demonstrate concepts marks were awarded accordingly, good marks were also awarded for those who made mention of operating distance and the concept of flame arrester of certain diameters restricted the passage of flame. At the bottom end of the scale were candidates who attempted the question but who had failed to understand its requirements. Candidates are reminded to read the question several times if necessary. If you fail to understand what is required, ask the examination invigilator for advice.

Question 3.8: *Discuss the advantages and limitations of the use of carbon monoxide as an automatic fire detection method.*

This was an even dispersal of points awarded to candidates who

attempted this question which reflects that many candidates did not understand the question. It clearly asks for the advantages and limitations of carbon monoxide as an automatic fire detection method. Why then did so many candidates submit in depth descriptions of CO_2 flooding systems? Others lost marks by describing the chemical properties of CO when again it was advantages and disadvantages that were required. Answers should have covered areas such as:-

1. Reliability in relation to other types of detectors.
2. Detection of poisonous CO results in an increased survival rate of occupants.
3. Immune to some false alarms sources etc.

Paper 4 - Building Construction

Question 4.1: *Detail the fire safety requirements for refuse storage and disposal facilities in multi-storey buildings.*

This question proved very popular with candidates who unfortunately appeared to answer the question based on their operational knowledge of refuse chutes and without taking reference from the bibliography for this question which is:-

1. BS 5906 1980
2. BS5588 Pt 1
3. BS 5588 Pt 3 1983

However, submitted scripts that included issues such as fire resistance, ventilation and house keeping/maintenance received good marks.

Question 4.2: *Describe the various uses of intumescent materials.*

A very popular question which looked for some depth of knowledge on the uses of this fundamental product used in fire engineering. Some candidates lost time in describing in detail maintenance and application techniques, however, additional marks were available for the mention of national standards. Model answers would include description of the main heading such as pipe and penetration sealing systems, gap filler seals, surface flame retardants and door seals.

Question 4.3: *Describe in detail the factors to be taken into consideration when anticipating the 'Fire Severity' within a building.*

Despite the question asking for a brief description, many long winded scripts were submitted, usually in an attempt to mask that the candidate was poorly prepared and lacked the specific knowledge required to answer the question.

Areas requiring attention should have included

1. Fire load
2. Fire load density
3. Nature of fuel
4. Compartment size
5. Ventilation
6. Thermal Insulation

The bibliography for this question is the 1991 Building regulations as well as reference to

1. The Cape guide to Legislation and Insurance Requirement
2. IFE Journal September 1992 Testing of Smoke Control Systems
3. BS 6336 Development and Presentations of Fire Tests and their use of Hazard Assessment.

Question 4.4: *Integrated fire safety systems usually involve a 'trade off' between the ' active and passive' measures to achieve an acceptable fire safety standard. Discuss.*

This question was looking for passive measures to be described with active measures being identified. Many candidates' scripts discussed far reaching issues and measures but failed unfortunately to mention actual systems or items. Marks were awarded to those candidates who were able to distinguish between passive and active measures. passive being structural and material against active which would include reference to detection, and extinguishing systems and facilities. A trade off must demonstrate positive equivalency. Exchange between measures must provide an equal level of protection.

Question 4.5: *Discuss the design considerations that are essential for a firefighting lift car.*

This was a very popular question with some high scores achieved by candidates. Areas that should have been included in answers which would have gained adequate marks to pass were such as national standard, sizes, speeds, power supplies, fire resistance etc. Some candidates proved ill prepared for this question and relied on their practical knowledge but without the inclusion of specific specifications.

This was inadequate to achieve a pass mark. Open ended statements like "adequate" or "considerations" were also often included in candidates answers. If these statements were made and if no further explanation accompanied the then this did not improve the answer.

Question 4.6: *Describe in detail the design requirements for a domestic sprinkler system and sketch a suggested layout.*

If this question had been specific, and aimed at Industrial sprinkler systems, then higher marks would have been achieved by candidates who mis-read the question and rather than discuss domestic sprinkler systems, submitted in detail descriptions of industrial systems. Domestic sprinkler systems are relatively new and where points overlapped between industrial/domestic systems then those marks were awarded.

Marks were awarded for answers that included:-

1. Design requirements
2. Water supplies
3. Control monitoring equipment

Question 4.7: *In relation to buildings, discuss external fire spread and the concept of space separation. In doing so, describe how you would restrict external fire spread and what assumptions you would make in specifying a reasonable standard of space separation.*

This straightforward question was not particularly well answered with very few candidates gaining a pass. Those candidates that did score well started by identifying mechanisms of the fire spread before going on to detail compartmentation and sprinkler systems. The quoting of regulations achieved few marks, the question was quite specific and asked candidates to discuss the principles of separation. Those candidates that included surface speed of flame and unprotected areas of buildings in addition to separation scored well.

Question 4.8: *Discuss the fire protection measures and engineering solutions you would consider when designing a purpose built leisure complex which hold several thousand people. The proposed structure will be made of synthetic material, and contain hospitality, exhibition and show areas.*

This was not a popular question and the highest mark was only thirteen. The issues raised under the umbrella of this question however are becoming more and more relevant as buildings are being designed with many different uses with associated specific occupants. Marks were however awarded for basic fire safety information but improved scores were achieved with the

inclusion of design issues such as:-

1. Excessive travel distances
2. Design for fire
3. Convected output and smoke management.

Moreover at Membership level candidates are expected to be familiar with more than just basic design issues.

Paper 5 - Management and Administration

Question 5.1: *Discuss the key elements when drawing up a policy for equal opportunities and fairness at work.*

This question was not answered particularly well. The bibliography "Equal Opportunities" by Margaret Penton contained the necessary elements of a strategy (for enactment of the proposed policy) which needed to be debated. Marks were lost by candidates who did not identify that an equal opportunity policy is a programme of action not an end in itself. A lot of candidates concentrated on the statutory requirements but not on how to turn them into an organisation's policy. Most candidates identified what equal opportunities meant but did not mention key elements as highlighted in the bibliography e.g. Monitoring, measuring, responsibility levels, underlying messages to employees and potential employees. This question stated "drawing up a policy" which implied before the policy had been formulated. Candidates should carefully read the question and also the recommended bibliography.

Question 5.2: *Fire brigades should be legally liable for their failure in extinguishing fire effectively and efficiently. Discuss.*

This question proved difficult for all candidates. The question was based around an article in the Institution journal in November 1999 by Professor Ann Rosemarie Everton. This article covered all the relevant discussion items and quoted legal cases of relevance. Candidates should always note the bibliography marks were lost due to candidates' lack of awareness of their Brigade's legal liability. Few, if any, candidates quoted the recent legal case of Digital Equipment Co. v Hampshire County Council. Most candidates who were aware of the potential for the fighting to go wrong gave good examples and also detailed methods to prevent re-occurrence. Following a request a few years ago to detail both a syllabus and more importantly a bibliography, candidates should have noted the key elements to it, have read Institution journal articles and *Management Techniques* by Michael Armstrong as core study material.

Question 5.3: *Discuss in detail the principle elements of Disaster Management and Emergency Management.*

This was an unpopular question; however the level of response was excellent, the majority of candidates demonstrated a clear grasp of the key principles and had written their answers having adopted a logical approach to these issues.

Marks were principally gained by mentioning the two principal stages:-

1. The Protective Stage and
2. The Reactive Stage

then adopting them further.

Candidates generally stressed the importance of pre-planning testing plans etc., and after candidates gained further marks with the inclusion of victim support, counselling and emotions. The Bibliography for this question was the Institution Journal article, "Disasters and Emergencies" written by Mr Bill Tucker in May 2000.

Question 5.4: *Describe how the training needs of an organisation and its workforce can be identified.*

Those candidates that attempted this question had difficulty in achieving a pass mark. Candidates tended to focus on training needs as they identified from their own experience in one area of their organisation. This was all well and good but the question was specific and required an overall strategy for the organisation. Marks were awarded to those who identified areas such as corporate, departmental and individual. Marks were all too often lost by candidates failing to mention issues like human resource plans, training surveys and job analysis. As a management task training needs to be seriously considered in all organisations. Candidates should be aware of methods of establishing training requirements as described in the recommended bibliography.

Question 5.5: *Explain what a job description is, how it is drawn up, and the ways it can be used within an organisation.*

Many candidates easily achieved a pass mark by setting out their scripts in a bullet point format with an associated logical sequence. The best marks were obtained by individuals who divided their answer into the three following broad categories:-

1. What a job description is.
2. How a job description is drawn up.
3. The ways a job description can be used.

The only common downside to this question was that some candidates confused role mapping with job descriptions.

Question 5.6: *Discuss in detail the factors that need to be taken into account for an individual to become an effective communicator*.

This was a popular question but candidates all too often lost marks by relying on their own past knowledge of perceived methods of effective communication. Others focussed their efforts on the types of communication rather the skills involved.

Better marks would have been awarded for covering issues such as "What is Communication", problems and overcoming them, feedback, use of correct language and most appropriate communication channel.

Candidates all too often mis-read the question and substituted the key word "factor" with types of communication and for many that was the beginning of the downward slope.

Question 5.7: *Identify the skills which an effective leader is likely to possess and explain why these are important.*

The question was attempted by the majority and was generally well answered. Candidates were clearly able to identify the core skills that a leader should have. Marks were gained for identifying skills such as consistency, decision making, honesty and communication. Some candidates were able to remember the bullet point headings but unfortunately were unwilling to elaborate on them. The question was in two parts which was not fully understood by some candidates, therefore candidates should read the questions over and over until familiar with the requirements.

Question 5.8: *Describe in detail three reasons why an individual needs to undertake a structured programme of continuous professional development (CPD).*

The highest score achieved for this question was nine, which at Membership level is disappointing. Candidates lost marks in a variety of ways. They generally were aware of the principles of CPD but could not detail how to achieve CPD.

Additional marks would have been achieved if candidates could have explained the benefits of obtaining further qualifications, submitted Articles in journals, seminars and lectures attended etc.

Although the concept of CPD is fairly new, several articles

regarding Continuous Personal Development have already appeared in its Institutions' Journal, and most professional organisations have a structured programme to implement CPD. Students must make every effort to keep abreast of evolving management principals.

Paper 6 - Fire Service Operations

Question 6.1: *Detail the main planning stages associated with preplanning for fires and other emergencies. Illustrate your answer by use of an appropriate example.*

This was a popular question and for the majority of candidates a pass was achieved. Some excellent scripts were submitted which approached the subject in a logical manner. Part of the question asked for an outline of the planning stages with an appropriate example, this unfortunately was one of the areas that candidates lost marks, the discussion did not always contain enough detail to be awarded the full 8 marks that were available.

The fire planning stages for this question were those of -

1. Assessment
2. Prevention
3. Prepare dress
4. Response and
5. Recovery

Question 6.2: *Discuss the major considerations when determining operational procedures at an incident involving radioactive materials.*

This was a popular question with some high scores being awarded to some candidates. Hindsight is a popular concept and if we apply that to this question and imagine we have arrived at an incident involving radioactive materials and apply the following to our action plan.

1. Establish a restricted area
2. Implementation of personal protective measures
3. Consideration of environmental pollution
4. Implementation of appropriate decontamination

If candidates had included discussion points to these areas then no doubt improved scores would have been achieved.

The bibliography for these questions can be found detailed within the UK Home Office Technical Bulletin. 2/93 incidents involving radioactive materials.

Question 6.3: *Detail the reasons for ensuring effective post-accident discipline at aircraft incidents away from airports.*

Surprisingly this question posed problems to the majority of candidates, which must reflect upon the degree of preparation undertaken for this type of question.

Marks were lost where candidates failed to detail the relevant reason for ensuring effective post accident discipline. These reasons are as follow:

1. Effective protection and control where wreckage has been spread over a wide area.
2. To ensure scene safety
3. To preserve evidence which may be needed for investigation

Question 6.4: *The potential exists for emergency services control rooms to combine, resulting in a shared or integrated facility. Discuss the impact that such a combination may have on service delivery.*

This was generally a poorly answered question, which for the lone candidate is surprising following the recent publication of the Home Office report *The Future of Fire Service Control Rooms and Communications*, which in fact was the bibliography behind the question. Candidates who did recognise the four areas of:

1. Response to multi service incident
2. Inter Service liaison
3. Information sharing
4. Call handling performance

generally did not offer sufficient detail to achieve a pass mark. With regard to this type of issue candidates need to be better prepared.

Question 6.5: *Discuss the need for effective inter-agency working when preparing for and dealing with the threat of environmental pollution at operational incidents.*

Many candidates failed to understand the requirements of the question and therefore the submitted texts generally contained irrelevant information. Candidates are therefore reminded to read the question several times and understand what's required before attempting to answer.

The factors that should have been addressed were those of:

1. Assistance and involvement in the design/procurement of equipment
2. Incident pre-planning arrangements
3. Provision of at incident advice
4. Information regarding decontamination/disposal

Question 6.6: *Discuss how operational procedures and the effective use of technology can assist in managing the reduction of malicious false alarms.*

Despite this subject being a topical subject for a number of recent years, many candidates who attempted the question failed to achieve a pass. The factors to consider for the benefit of revision are:

Operational proceedings

1. Targeting of malicious false alarm risk areas
2. Non mobilising to abusive/abandoned calls
3. Reduced attendances to known malicious false alarms

Use of Technology

1. Automatic call tracing
2. Calling line identification
3. Use of geographical information system to provide management information, re - malicious false alarms.

Question 6.7: *Produce an outline specification for an Information Technology-based system for the management of equipment.*

Candidates generally answered this question in a satisfactory manner, and the majority achieved a pass mark. The areas of the answer that were generally forgotten are those of:

1. Systems to be easily accessible by relevant persons.
2. Systems to incorporate one point data input
3. Systems to be integrated with each relevant data source
4. Systems to contain full life cycle information

Question 6.8: *You have been instructed to investigate the feasibility of introducing a helicopter capability into your Fire Service. Identify the factors to be considered during the research process.*

This was a popular question in which the candidates generally achieved a pass mark by identifying the major factors in a logical manner. Marks were either won or lost for the information submitted in the following areas.

1. Service delivery Requirements.
2. Associated issues i.e., Training, health and Safety etc.

3. Cost / Benefit analyses i.e., financial issues

For the candidates who failed this question, be aware that this is a topical question with organisations continually trying to improve their Services to the public, and this type of question may well appear again.

Paper 7 - Aero Fire Studies (Optional)

Question 7.1: *Describe in detail the personal qualities which may be regarded as essential when selecting personnel for appointment and promotion within an Airport Fire Service.*

This was a popular question which generally was answered well. The candidates that achieved higher marks gave detailed descriptions of the personal qualities rather than just a list in their answers. Physical ability and intelligence are good examples of the qualities for appointment, whereas competence and leadership qualities are essential when considering promotion. The bibliography for this question is *Airports and Aircraft Fire Protection, Firefighting and Rescue Techniques* - IFE Publications page 43.

Question 7 2: *Discuss the factors which should be considered when assessing the provision of water supplies for firefighting at an airport.*

Many candidates achieved high marks for this question and their answers generally contained issues such as

1. Ring mains
2. Use of open watch
3. Provision of bowers and watch carriers.

Other areas covered by the high scoring candidates were access, marking of supplies and the provision of watch for the associated risks such as aprons and terminals. Additional marks were available for making reference to airport fire categories and the calculation of critical areas. Unfortunately marks were lost by concentrating on detailed descriptions of the state protection to terminals and hangers.

Question 7.3: *Detail the priorities which must be considered in terms of post accident management.*

This was a popular question and awarded marks were divided between those candidates who had obviously prepared themselves, and had read and understood the question, as opposed to those whose areas lacked a detailed knowledge of this subject.

Higher scores were obtained by those candidates who identified the key issues, such as:

1. Scene preservation and accident investigation
2. Draining and removing fuel from the wreckage, and
3. decontamination.

Candidates are reminded to read the question carefully, understand the question, and try to structure the answer with a logical approach.

Question 7.4: *Discuss the radio communication needs and options for airport rescue and firefighting*

Candidates viewed this as a difficult question and therefore it was very unpopular. Submitted scripts contained little detail and easy to achieve marks were all too often lost, by not mentioning the obvious communication requirements i.e.

1. Portable radios
2. Radio links with Air Traffic Control
3. Ground to air communication link with rescue and firefighting vehicles.

Candidates who attempted this question, who had not prepared themselves, could have pictured themselves at a major airport waiting for a large passenger aircraft to approach the runway, with a known on-board problem and thought: who needs to communicate, to who and why and if these links are required, what equipment will facilitate the system.

Question 7.5: *a) What are the causes of passenger aircraft cabin fires? and b) Describe in detail the associated problems when dealing with such incidents.*

It was apparent that many candidates had not read the bibliography as their answers reflected popular perceptions of the problems associated with aircraft cabin fires. Such answers would have just about attracted a pass. Marks were gained by candidates, who were able to identify, special causes of cabin fires and who were also able to discuss particular problems associated with the type of fire. Low marks were also awarded to the candidates who digressed into wheel fires, engine fans and refuelling processes.

While a general knowledge of aviation firefighting techniques was useful. Candidates are advised to study the relevant articles in the IFE publications which describes the problems and tactics in some detail.

Question 7.6: *Describe the construction features of helicopters.*

This question did not prove to be very popular with candidates, although the bibliography is well covered in the IFE Airports and Aircraft publication. Some candidates did waste time and effort detailing the firefighting procedures to be adopted with helicopters, whereas a pass mark was easily achievable by detailing descriptions of the type and construction of materials used for the following:-

1. Airframe
2. Undercarriage
3. Fuel tasks
4. Engines and Rotors

Question 7.7: *Discuss the dangers present and the actions required to reduce risks to fire-fighters and the environment during rescue operations involving a passenger aircraft which has crashed into water adjacent to the airport boundary.*

Popular question, many candidates scored well and attracted high scores, by discussing the actions required in respect of the unburnt fuel on the surface of the water, and the sections of the aircraft which may be floating or partially submerged. Pre-planning is clearly an important consideration, as is liaison with rescue boats, helicopters and hovercraft.

Question 7.8: *Discuss in detail the personal protective clothing/equipment necessary for airport firefighting and rescue personnel.*

Many candidates submitted full and accurate answers. The candidates who attracted poor scores obviously had not studied the bibliography associated with these type of questions, and had simply described conventional fire kit. Marks were gained by candidates who could clearly differentiate between entry and proximity suits. A general knowledge of personal protective equipment was insufficient to attract a pass mark, candidates are advised to refer to the IFE publication, *Airports and Aircraft Fire Protection* for the model answer.

Paper 8 - Fire Investigation

Question 8.1: *Vapour density is important to the fire investigator. Discuss*

This question was generally poorly answered, most attempts offered answers that were too simplified for member level.

Marks were missed by not defining vapour density or defining it incorrectly. Many candidates failed to explain the effect of vapour density on the diffusion of gases to make a stoichiometric mix and impact of air movements. Easy marks could have been gained with the use of accurate diagrams. A knowledge of basic chemistry was not enough to achieve a suitable pass mark, candidates needed a broader understanding of this field of chemistry and should therefore be better prepared in future.

Question 8.2: *Explain the purpose of an electrical transformer and illustrate how an investigator might recognise the origin of fire in such equipment.*

The bibliography for this question was the NFPA 921 Guide for Fire and Explosion Investigations 1998 edition, page 134, para 18.5.5. If more candidates had read and understood this bibliography then the marking sheet would have looked different, for candidates generally understood the first part of the question but displayed a lack of knowledge for the second fire investigation part.

Marks were lost by not covering the importance of whether the transformer was energised or not, failing to explain misleading signs of transformer damage from external fire, and how investigations can determine whether a transformer is the source of a fire rather than just involved in fire. Candidates must read the question, understand its requirements and attempt to answer all of the areas asked for.

Question 8.3: *Define the term 'static electricity'. Explain in detail how it can contribute to fire and explosions in industry.*

A relatively well answered question by most candidates, although some answers did lack the brevity required at membership level. Marks were lost for the definitions of static electricity that were too general and lack explanation of the phenomenon, and for insufficient detail with regard to industrial processes where static can cause fire and explosions. Candidates are reminded that when asked to define a scientific term, a scientific answer should be given, likewise detailed scientific explanation rather than just broad examples of how static can contribute to fires etc are expected.

Question 8.4: *Describe in detail the construction of Motorhomes/Campers/Recreational Vehicles, and explain the fire risks that they may present.*

A generally well answered question with most candidates covering the main areas required. Additional marks were gained by those candidates who gave greater detail on vehicle construction and related this detail specifically to the associated fire risks. Candidates who included the following issues scored well, and if a diagram had been included detailing the main construction points, there could have been a chance to achieve maximum marks:-

1. Combination of vehicle and dwelling fire risks
2. Problems associated with 12v, 24v and mains electricity
3. LPG i.e. butane and propane
4. Cabin construction and furnishings

Question 8.5: *a) Discuss in detail the use of a Fire Investigation Dog/Canine Handler team in the investigation of fire; and b) Describe the principles employed in the training of such a team.*

Very few candidates attempted this question which probably reflects the relatively recent use of canine Fire Investigation teams and restrictive availability of written study material. Moreover the candidates that did attempt the question generally scored well. The candidates who had read and understood the question did answer both parts and scored well by the inclusion of some of the following points.

1. Role of Dog team (Hydrocarbon/Explosive/Body) Location
2. Limitations and capabilities of dogs in these three areas
3. Use to gain confirmation by sample analysis
4. Method of training and alerting

Candidates are reminded to read the question and give balanced arguments.

Question 8.6: *Design an investigation flow chart for use in the management of major fire investigations.*

This was a popular question with only a few candidates offering sufficient detail to gain good marks. Some candidates obviously hadn't read the question, for although the question asked for a flow chart, some candidates produced lengthy narratives. Generally flow charts that were submitted were too simplistic and missed many of the important considerations that were required to achieve high marks. Candidates are reminded to answer the question, if it asks for a flow chart, produce a flow chart, include details of actions/consideration. Don't make statements like "investigate", "establish cause", without other supporting information.

Question 8.7: *Discuss a methodology for the investigation of vehicle fires.*

Congratulations to the candidates who had undertaken the necessary preparation for the question. Candidates must remember that if the question asks for a discussion this is what is required not just bullet points. This was where some marks were lost. The other all too common area where marks were lost was when considering the Health and Safety implications when investigating this type of fire.

Question 8.8: *Describe in detail how Fire Investigators should employ best practice principles of Health and Safety before and during an investigation.*

A very popular question, most candidates included sufficient detail to attract reasonable marks. The main areas that were not answered in sufficient detail were those of:-

1. Poor training
2. Illumination
3. Environmental hazards e.g. road, rail, animals and hostile persons

As was the case with many questions within the paper, answers were required in the form of a discussion. This was not understood and some candidates only submitted subject headings and included no detail. Read the question.

Paper 9 - Marine Fire Studies

Question 9.1: *The laws of salvage have an important bearing on the role and responsibilities of the fire officer. With regard to this: a) Define the term 'wreck'; b) Discuss the implications regarding any Liability and; c) Explain the agreement covering salvage claims*

This question came in three parts. Candidates seemed at ease with part 'A' to define the term 'wreck', but appeared to have insufficient knowledge regarding liability and the "no pay" agreement surrounding salvage claims. Candidates were therefore ill prepared, which at membership level is disappointing.

Question 9.2: *Describe in detail the methods of construction in passenger ships that are required to limit fire spread.*

Some candidates had prepared well and their knowledge was apparent whereas others appeared to be clutching at straws. There was of course middle territory which included candidates

who displayed excellent knowledge in some areas and limited knowledge in others. Candidates on occasion went into great detail describing the pre-tests for the various classes of bulkhead, all well and good, but no marks were awarded for this as it wasn't asked for in the question. More consideration for future attempts should be given to means of escape including stairs, corridors and atria.

Question 9.3: *Detail the fire protection arrangements imposed by SOLAS regulations for dangerous good in cargo spaces.*

This was an unpopular question and scripts submitted at membership level are best described as disappointing. Candidates all too frequently spent time describing dangerous goods, and labelling arrangements rather than concentrating on the issues of the questions. Inadequate detail was given regarding air sampling, fixed installation, ventilation and bilge arrangements. Candidates were ill prepared and for revision purposes the model answer can be found in the Fire Institutions *Marine Fire Studies Manual*, pages 58, 59 and 60.

Question 9.4: *Explain in detail how the uneven distribution of loads causes a ship to 'list'. Give the reasons why*

This is a common area of questioning for any marine fire studies paper and it is therefore disappointing that many of the candidates were ill prepared to achieve high marks. The question asked for a detailed explanation of the mechanisms that cause list and heel. This however was very thin on the ground. Good marks were awarded for explanations of the effect on the centre of gravity and consequently the centre of buoyancy by an added load. Clear diagrams were also a must and if correctly drawn and explained could have supported the submitted scripts. For revision purposes the model answer can be found in the Marine Fire Studies manual, pages 78, 83, 84 and 85.

Question 9.5: *Discuss the use of carbon dioxide as an engine room fixed firefighting system.*

This question was centred around the use of Carbon Dioxide. Descriptions of Carbon Dioxide systems were peripheral to the answer and only a small proportion of marks were awarded for this aspect. The discussion should have centred around the effectiveness of Carbon Dioxide as an extinguishing media. At this level candidates must be able to expand upon the points being made to gain high marks. Most candidates knew the list of advantages and disadvantages but did not explain the implications of these. For example many made the point that Carbon Dioxide has very little cooling effect, but did not expand that that to mention that re-ignition can occur and damage to systems by heat would continue possibly disabling them and the ship.

Question 9.6: *Discuss ventilation as a technique that may be employed during firefighting operations aboard ships.*

Candidates again failed to discuss the advantages and disadvantages of carrying out ventilation and minimalised their answers to the description of ventilation techniques. Answers should have included the different actions that may have taken place by ships officers and fire officers, the moral conflicts in passenger ships of venting vs closing compartments, as well as descriptions of the various ventilation techniques.

Candidates tended to rely on their general firefighting knowledge rather than the more in depth knowledge acquired by further studying prior to the examination.

Question 9.7: *Describe the planning process that you would use to ensure the safety of firefighters whilst fighting fires in ships offshore.*

This was a popular question but the majority of candidates failed at the start. Candidates completely ignored the central phrase i.e. "To ensure the safety of firefighters". This question was therefore about the process used to ensure the safety of firefighters and not about pre-planning for fire offshore. Marks were all too often lost because candidates spent too much time concentrating on the logistics of getting firefighters offshore. The answer required a description of identifying hazards, applying control measure, ensuring personnel are trained, informed and provided with suitable equipment information, supervision and systems of work and finally recognising the review process and revision of plans. This question required candidates to draw on information across the full range of the bibliography not just a small specific section.

Question 9.8: *Discuss the factors that fire brigade officers need to be aware of when consideration is being given to abandoning, beaching or bringing a stricken vessel into port.*

In general candidates were able to identify many of the factors involved but did not identify the conflicts of interests associated with each point between the relevant authorities, owners, masters of the ship and the fire officer. The factors associated with access needed to be discussed, and no candidate identified the difficulties associated with taking a ship into a foreign port. Candidates are therefore reminded to prepare well in advance of this or any examination so that their answers reflect a good understanding of the question's subject.

Paper 11 - Disaster Planning and Emergency Management (Optional)

Question 11.1: *Discuss in detail the safety considerations of the emergency services in dealing with the hazards associated with a major incident.*

This question was generally well answered and candidates did in fact focus their answers on the safety considerations at a major incident. Marks were however lost in providing over elaboration on command and control principles, which were not asked for. Other marks were also lost for over elaboration regarding training exercises used to train for major incidents or the planning involved of these exercises. Candidates are therefore reminded to read the question and underline the key words and focus their answers around these key issues.

Question 11.2: *Describe the purpose of a Survivor Reception/Rest Centre both in the proactive and reactive stages of a major incident.*

Of the total marks available for this question it was disappointing that the highest score achieved was 12. This clearly demonstrates that candidates had not prepared themselves adequately for this question, a view that was reinforced by the confusion some candidates had in distinguishing Survivor/Rest Centres for the function adopted by the Police Casualty Bureau. The higher scores were achieved for those candidates who could demonstrate a reasonable knowledge of the subject and who were also aware of proactive measures i.e. planning before the incident and reactive measures which, occur during the incident. Candidates are reminded to prepare themselves adequately for this question area.

Question 11.3: *Detail the purpose of a Police Casualty Bureau and describe how it should operate following an incident involving mass casualties.*

The debrief comments regarding this question go hand in hand with question 11.2. Candidates generally were confused with the differences between a Police Casualty Bureau and Survivor/Rest Centres.

The three main functions of a Police Casualty Bureau are

1. Gather information on persons suspected of being involved
2. Processing the information in terms of verification/ disqualification.
3. Providing accurate information & investigate agencies and relatives.

More preparation is required if candidates expect to achieve a pass mark especially at Membership level

Question 11.4: *Describe the role of the embalmer and funeral director in dealing with a large number of victims from a disaster involving a passenger aircraft on an international flight.*

Although this was an unpopular question, congratulations to the overseas candidates who achieved the highest score. This question focused on the role of the embalmer and funeral directors when dealing with an international flight. Good answers covered the points of:

1. Preparation of bodies for viewing
2. Burial arrangements and
3. Immigration arrangements in body repatriations

The question was set in a particular context which should have influenced the content of the answer. Candidates should make reference to the context when supplementing their answers with general comment on individual roles.

Question 11.5: *Explain the term 'Post Traumatic Stress Disorder (PTSD)'. Describe who may be affected and what are the symptoms?*

A very popular question which reflect the high profile currently given to Post Traumatic Stress disorder. Good marks were achieved which in many cases was supported by personal experiences of the effect of exposure to traumatic events. Good marks were also awarded to candidates who were able to define PTSD and put it in the context of' normal reactions' to an abnormal event. Some candidates answers did however drift into debriefing and counselling which was not what the question asked for and therefore no marks were awarded. Candidates are therefore reminded to read the question several times to get a feel of the subject and what exactly is required of the answer, and structure the answer in a logical sequence.

Question 11.6: *Discuss the financial implications for a local community in the aftermath of a large scale incident.*

This was a popular question, candidates generally were aware of the issues of financial loss, and recovery following a large scale incident. Good marks were awarded for identifying where loss occurs for individuals and economic loss in the longer term. At Member level candidates should be able to articulate the social economic nature of disasters as it effects local communities and be able to relate these to the question.

Question 11.7: *Discuss the needs of the media in responding to a disaster of international scale.*

This was a very popular question which attracted some excellent scripts, candidates had obviously read and understood the requirements of this question and attempted to cover all the relevant issues. Good answers were singled out in particular for those candidates who mentioned the delicate balance between the media intrusion set against their rights.

Question 11.8: *Describe the categories of emergency volunteers who respond to major civil emergencies and list the type of support activities that they provide*

This was the most popular question of this paper and both home and overseas candidates achieve excellent marks. Additional marks could have been available if candidates had not confused the roles of volunteers with the professional services who would normally respond in the first instance. Candidates that were able to appreciate the support role of volunteers in a major civil emergency were better able to achieve higher scores.

The four broad categories of volunteers are as follows

1. Established organisations such as British Red Cross and the WRVS
2. Those with specialist skills, an example, group of doctors voluntary radio operators, and the Royal National Lifeboat Institution.
3. Individuals whose help is requested or offered on the day.
4. Organisations which specialise in providing emotional support, such as Cruse and the Samaritans.

Candidates at Membership level must research the roles of voluntary support which has been fairly documented in the media and disaster enquiry reports.

Graduateship Examination

Paper 1 - Fire Safety

Question 1.1: *Building materials are subjected to 'Fire Tests' to simulate as accurately as possible, the situations a material could be involved in at a fire; however, it is impossible to simulate an almost infinite variety of different fire scenarios that could involve any material. List and briefly describe the factors, which, in a real fire situation, would have a bearing on materials behaviour.*

Many of the candidates clearly read and understood the requirements of the question, which was to list and briefly describe the factors which in a real fire situation would have a bearing on materials behaviour, and for these candidates high marks were achieved.

Other candidates unfortunately however, misread the question and detailed in depth the tests of ignitability, combustibility and surface spread of flame.

Question 1.2: *Increasing use is being made of aluminium and its alloys for structural and cladding members, which has introduced new fire problems. a) List the advantages and disadvantages of using aluminium alloy in building, and b) Briefly explain why unprotected metal surfaces constitute a serious risk in a fire*

The majority of candidates were obviously more familiar with the requirements of part A than part B of the question and therefore there was a difference in marks between the two sections.

In the building industry today, increasing use of aluminium and its alloys is being used and at Graduate level it was expected that candidates would have been familiar with its advantages and disadvantages.

Part B asked for a brief explanation of why unprotected metal surfaces constitute a serious risk in fire, this part as explained above, attracted poor scores. If candidates could have explained that structural steel loses 2/3 of it's strength at 592ºC and in proportion to the amount and direction of the load to which it is subjected begins to twist and sag, then 4 marks could easily have been awarded out of the 11 marks that were available for this part of the question.

Question 1.3:*Comment upon the behaviour of each of the following types of beam in a fire situation; a) Timber, b) Steel, and c) Re-inforced Concrete*

This was a very popular question and congratulations to the 50% who obtained a pass mark.

The most obvious points relevant to the answer were normally covered, but there were also other marks available to candidates who explained issues such as "protection", tensile strength and the performance of each type of beam when involved in a fire situation.

This question should at first glance have seemed simple and straightforward but some scripts contained lengthy texts, including diagrams that were not in context with the requirements of the question.

Question 1.4: *Automatic sprinkler systems must be provided with suitable and acceptable water supplies. a) Name the 3 categories into which such water supplies are graded, and b) Give brief details of the acceptable supplies under each category.*

This was not a popular question and few candidates achieved a pass. The majority of answers were being driven towards occupancy risk categories and away explaining, "Single, Superior and Duplicate water supplies with an accompany list of water supplies acceptable to each category

Unfortunately this was a clear case of either not reading and understanding the question or not having achieved an acceptable level of knowledge for this subject matter.

Question 1.5: *If fire safety management is to be effective, a plan tailored to meet the needs of the particular building and its occupants is necessary. Briefly outline the area such a fire safety plan needs to contain/identify.*

Few candidates attracted high scores for this popular question, the majority of candidates displayed an excellent understanding of:

1) Staff training
2) Appropriate fire procedures
3) Fire prevention procedures
4) Maintenance and regular testing

Only a few realised that a competent management structure is required to implement the overall strategy plan.

Question 1.6: *A Head Teacher of local school requests advice following a minor arson attack. Draw up an action plan highlighting preventative measure for consideration.*

Congratulations to the two candidates who attained a score of 17. They had obviously prepared for this topical area of questioning.

For the other candidates who either achieved a pass, or who unfortunately failed it is now obviously too late to reconsider the question, but let's look at the big picture and focus on the preventative measures to be included in an action plan.

There are five distinct areas, these are:

1) Deter unauthorised entry into the site.
2) Prevent unauthorised entry into the building
3) Reduce the opportunity for an offender to start a fire
4) Reduce the scope for potential fire damage
5) Reduce subsequent losses and disruption from a fire

The bibliography for this question was the Fire Engineers Journal September 99, Volume 59, No 202, page 26.

Question 1.7: *Outline the principles of taking photographs at a property, for fire investigation purposes.*

This was not a popular question and candidates generally fail to identify the four areas of:

1) General principle of photography
2) Photographing the exterior
3) Photographing the interior
4) Photographing of points of entry and security.

Further marks would have been available to candidates who could offer practical aspects and who could have demonstrated a working understanding of this particular subject.

Question 1.8: *Briefly explain and give examples how glass can provide evidence to assist in the understanding of events prior to and during the fire.*

A very popular question many excellent scripts were received, indeed one candidate achieved a score of 19, well done.

Candidates generally demonstrated an excellent knowledge of the subject matter, and explained the different effects on glass during either rapid or slow build up of heat and the different ways in which glass will crack or break.

Marks were also awarded to those who understood the importance of examining the condition of the edges of the glass to determine at what stage the glass had broken.

An interesting aspect to the question was covered by the majority of candidates, and that was the appearance of a heated light bulb; although this is important during a fire investigation, this evidence can not be relied upon unless the light fitting was substantial enough to withstand the effects of the fire and maintain the light bulb's position, ie not rotating on an electric cable.

Question 1.9: *In order to achieve an acceptable standard of means of escape, architects, fire engineers etc, need to understand a number of basic principles. Briefly outline those principles.*

This was a popular question that unfortunately was answered very poorly, to understand the question better; in your mind, put yourself within a building on an upper floor and think about the issues that affect your means of escaping from your floor to a place of safety.

The points that you should be considering are: are there sufficient escape routes available, are they adequate and wide enough for the number and type of occupants that need to use them, how far will you have to travel to effect an escape, do you have adequate protection from the effects of fire whilst you are effecting your escape, do you need to use external escape routes and again, are they protected against the effects of fire, and can you easily identify where these exits routes are, and are they safe to use at night with emergency lighting.

Hindsight is a wonderful concept, but you see now how you could have approached the answer to this question and possibly achieved a higher mark.

Question 1.10: *a) Outline the two basic methods of providing adequate ventilation of hot smoke from a building, and b) In relation to your answer, list the advantages and disadvantage of each system.*

A very popular question but candidates unfortunately either had not prepared themselves for this avenue of questioning, or had not read and more importantly understood the question.

Candidates should have been outlining "Natural and Powered Vents" and then listing the advantages and disadvantages of each system.

Often was the case that candidates lost valuable time and marks detailing horizontal and vertical ventilation, offensive and defensive ventilation was also explained in detail but unfortunately attracted no marks.

The model answer for the question was drawn from an article on page 16 of the IFE Journal March 2000.

Paper 2 - Operations

Question 2.1: *Explain the essential features of a communications system for use with BA.*

For operational fire fighters this should have been seen as an excellent opportunity to gain valuable marks. In fact quite the opposite happened, this was an unpopular question with few candidates achieving a pass mark.

For many, the opportunity to demonstrate their knowledge of line signals and guide line procedures proved irresistible and time and effort was wasted as the line of explanation was not asked for in the question.

Other candidates relied upon their operational experience, which generally lacked the required depth of knowledge to achieve a pass mark. Candidates are therefore reminded to fully read and understand question prior to attempting an answer

Question 2.2: *Describe the principles of operation of an auto-resuscitator*

Congratulations go to the three candidates who submitted excellent scripts. They all demonstrated an excellent depth of knowledge regarding this item of equipment, for the majority of candidates however, their knowledge of auto resuscitators proved limited and few pass marks were achieved.

Generally candidates substituted the required information with details of how to check and use this equipment at incidents which gained no additional marks, the question was looking for information which included detail as -:

1) Pressure, time and volume cycling operations
2) Demonstrated an understanding that both oxygen and compressed air supplies could be used etc.

Question 2.3: *Describe in detail the classification of fire fighting foam*

This question should have been read and understood prior to putting pen to paper. Candidates should jot down comments, ideas and construct their answer with a methodical approach.

If candidates had adopted this approach then higher scores could have been achieved especially for those people who submitted scripts detailing the different types of foam available rather than their characteristics.

Time was also wasted drawing diagrams, some quite elaborate which unfortunately bore no relation to the answer that was required.

Question 2.4: *Define the following terms and explain the signs and symptoms associated with each: a) Flashover, and b) Backdraught*

This was a popular question and the majority of candidates displayed an acceptable understanding of these principals.

Marks were however lost by candidates not demonstrating a comprehensive knowledge of the signs and symptoms of flashover and backdraught and an example of this was that candidates identified pulsating smoke as a sign of impending backdraught but did not explain that this was, in fact, the effect of mini backdraughts.

The question did ask for definitions which should be kept short and precise, some candidates submitted answers with long descriptions and illustrations which lost them valuable time for the rest of the examination.

Question 2.5: *Define the following terms in relation to fires onboard signs: a) Boundary cooling and b) Boundary starvation*

This proved to be an unpopular question and for the few that did attempt it, pass marks were scarce.

It was obvious from the scripts that were submitted that candidates in general did not have the required depth of knowledge and had possibly therefore entered into this question ill prepared.

Marks were often lost for not making mention of:

1) Ships stability due to the water
2) The problems incurred with spot cooling and
3) The overall ships structural integrity

Question 2.6: *Discuss the firefighting and safety procedures to be adopted by the fire service at an incident involving a train on an electric railway system*

This was the opportunity to achieve high marks especially for those operational fire-fighters who undertook this question. However the marks achieved were disappointingly poor.

Candidates appeared to rely too heavily on their experience of local brigade procedures rather than a sound knowledge of the

principles set out in guidance note study material.

Some of the uncommon procedures that were frequently overlooked were:

1) The use of minimum number of personnel
2) Weather conditions
3) Nature of incident
4) Location of incident
5) Local topography and geographical features and
6) Places of safety to be made aware to crew members

Candidates must accept, therefore, that the application of common sense judgement and limited practical operational experience may not be sufficient to gain enough marks to achieve a pass mark, unless supplemented by a carefully planned and structured study.

Question 2.7: *Discuss the principles and benefits of 'positive pressure' ventilation at an operational incident*

When you consider the worldwide use of PPV fans and the associated training regularly undertaken by Fire Engineers and the articles published on the subject. It was disappointing how poorly this question was answered.

Many candidates failed to read and understand the questions requirements and rather than discussing the principles and operational use of this equipment, their answers were directed towards the deployment of these fans and candidates therefore wasted valuable examination time and lost valuable marks.

Question 2.8: *Explain the factors to be considered when 'active prevention of avoidable damage' is being applied at a fire involving a multi-occupied building*

At Graduate level candidates are expected to understand the principles of salvage and answers should have included the basic techniques that would be applied:

1) Covering items susceptible to damage
2) Prevent water flowing into unaffected areas by damming
3) Deal with burst pipes and,
4) Deal with sprinklers at the earliest opportunity

There were 20 such points, each attracting 1 mark. This question should have provided a good mark for candidates but this opportunity was not taken.

Question 2.9: *Detail the safety procedures to be adopted when dealing with a fire in a building where LPG cylinders are present*

This proved to be a popular question which unfortunately was poorly answered. The candidates that approached this subject in a logical sequence gained the best marks, whereas those candidates who did not fully understand this subject appeared to rely on their own limited operational experience and achieved poor marks once again. This is proof that a sound knowledge, based on study is essential.

Question 2.10: *As Officer in Charge of a fire involving a large goods vehicle carrying hazardous substances, detail: a) The markings that you may expect to be displayed on the vehicle and b) The information provided for aiding fire-fighters*

A Few scripts achieved good marks from this very popular question. Candidates clearly did not read and understand the question as many of the scripts received went into great detail regarding operational procedures and decontamination, rather than focusing on what the question asked for.

Paper 3 - Fire Engineering Science

Question 3.1: *The following data relates to the number of callouts for the period shown from three different stations in one brigade. Using the data provided, plotted in the most suitable form, predict the number of annual call outs from each in the year 2005.*

Year	*Station A*	*Station B*	*Station C*
1996	*206 (Jan-Feb)*	*925(Mar-Aug)*	*325 (Nov-Dec)*
1997	*331(May-Jul)*	*305(Jan-Feb)*	*300(Aug-Sept)*
1998	*472(Jun-Sept)*	*603(Jan-Apr)*	*567(Sept-Dec)*
1999	*126 (Dec)*	*597(Feb-May)*	*537(Aug-Nov)*
2000	*400(Feb-Apr)*	*596(Jun-Sept)*	*258(Nov-Dec)*

Congratulations to the small number of candidates who achieved a score of 18 for this question. This was contrasted by almost half of the attempts that failed to attract high marks. Often because of a failure to realise that each year needed to be isolated to provide the basis for a meaningful prediction.

To achieve this the number of call outs relating to each year needed to be divided by the number of months in question to give an average monthly figure for that year. This figure then needed to be multiplied by twelve to provide the average annual figure.

These annual figures then needed to be plotted, preferably on a graph in order to establish an annual prediction based upon available data.

Question 3.2: *A mass of 2 Kg is thrown downwards from a height of 5 metres with a velocity of 4m/s. What is the total energy during the motion and how fast will it be moving when it is 3 metres above the ground? ($g=9.8m/s^2$)*

Many candidates who had not studied the subject sufficiently answered this question. Those candidates however who were prepared and who also set their answers out in a logical sequence did, in fact, achieve excellent scores.

Some candidates did fall into the trap of using the wrong formula, and some did not understand the concepts of kinetic, potential and motion energies.

Question 3.3: *In a 12 V electrical circuit the current flowing through a wire is found to be 1500 milliamps. If the wire is made of copper and is 900 metre in length, what is the diameter of the wire used? (Resistivity of copper = 1.56×10^{-8} ohm metre)*

This question was not very popular amongst candidates and with the exception of a few excellent scripts was poorly answered.

Candidates did gain valuable marks when all working out was shown and candidates demonstrated knowledge of this subject by approaching the question with a logical progression of thought using the information gained in each section to proceed to the next.

Candidates also generally had difficulty in the four following areas and additional studying will be required if the paper is re-taken next year.

1) Difficulty found in changing milliamps to amps
2) Difficulty in transposing formula
3) Difficulty in using powers eg 10^{-8}
4) Difficulty converting metres to millimetres

Question 3.4: *a) Describe the function of a nozzle; b) Outline two factors of the supply which will affect the maximum height; c) The pressure at a 25 mm nozzle is 6 bar, what will be the height of an effective fire fighting jet? and; d) What other factor could affect the height of the jet?*

This was the most popular question of this paper and generally was well answered. Two candidates stood out with full marks and congratulations are forwarded to them for having prepared so well for this area of questioning.

The two parts of the question which generally were preferred by candidates were those Part A and C. Candidates showed little problem especially working with the formula for an effective fire

fighting jet.

Part D was poorly answered and many candidates ignored it completely. The two other factors that the question setter was looking for were those of:

1) The nozzle must be free from damage, and
2) The effect of high winds.

Question 3.5: *a) Define the terms: (i) Specific Heat Capacity, (ii) Latent Heat Capacity; b) An electric kettle is rated as 2.1 Kw, has a mass of 0.4 Kg and is metal. How long will it take to bring 1.2 Kg of water from a temperature of 16ºC to the boiling point? and; c) If the thermal cutout fails and the kettle continues to boil for a further 10 minutes, what mass of water will have boiled away?*

This question was answered well by the majority of candidates and many easily gained passes. These candidates displayed a clear understanding of the subject.

High marks were awarded for clear concise definitions and understanding of the formula, together with logical calculations. For revision purposes it may be useful to note that the correct answers to part B and C were 3.5 minutes and 0.56 Kg respectfully.

For the candidates who failed this question they will have realised that there is no substitute for preparation prior to an examination.

Question 3.6: *A fireboat is propelled by a branch ejecting water.; a) If the nozzle diameter is 25 mm and the pressure 7 bar what acceleration will the boat attain if it has a mass of 1.2 tonne, and; b) Calculate the momentum it will have 5 seconds after it begins to move?*

A large proportion of candidates attempting this question obtained a pass mark. The question was in two parts and it was necessary to complete part (a) to calculate the momentum in part (b). Clear and logical workings help not only to show how the answer was achieved but also ensures that all areas are covered and nothing is overlooked. In the era of the calculator marks can be lost if the examiner is unable to trace a mathematical error.

Candidates who failed to complete part (b) also lost marks.

Question 3.7: *a) Define the term 'mole'; b) Potassium nitrate (KNO_3) when heated gives off oxygen according to the equation $KNO_3 = KNO_2 + O_2$, Balance this chemical equation; c) If 10 Kg of the nitrate becomes involved in a fire what volume of oxygen will it produce? and; d) If this amount of oxygen is then confined within a small shed measuring 3m x 2m x 2m what will be the percentage of oxygen in the air?*

Those who had studied and applied themselves to this elementary avenue of chemistry gained reasonable pass marks.

Surprisingly nearly all candidates failed to correctly define the 'mole'; this is simply the molecular mass of a compound expressed in grams.

For those candidates who were unsure how to balance the following equation: $KNO_3 = KNO_2 + O_2$, then the answer required to achieve equilibrium and to give the same number of atoms on each side of the equation would be:

$$2KNO_3 = 2KNO_2 + O_2$$

With regard to parts C and D of the question, the application of a logical approach and calculation process and setting the answer out in a logical sequence, would assist the marker to understand the direction that the candidate was taking and would assist in the award of higher marks.

Question 3.8: *a) Define the following terms used in radioactivity; (i) Isotope, (ii) Radioisotope, (iii) Half-life; b) Use the following data and a suitable graphical method to determine the half-life of the element shown.*

Time(mins)	*0*	*15*	*30*	*45*	*60*	*75*	*90*	*105*	*120*
Disintegrations	*556*	*478*	*363*	*297*	*263*	*233*	*171*	*140*	*130*

and; c) Give an example where an element with (i) A short half-life, (ii) A long half-life, would be used in practice

This proved to be a popular question but unfortunately Part a) was poorly answered. Few candidates appreciated that an isotope is an element with the same atomic number but a different atomic mass.

Very few candidates displayed knowledge of radioisotope and were unaware that it is radioactive and usually manufactured synthetically.

The majority of candidates as expected, had an excellent knowledge of radioactive half-life.

Part b) of the question required the candidate to achieve a solution by the use of a graph, to most candidates this concept was clearly understood and excellent examples were submitted.

Most candidates were able to give examples of elements with long half-life in Part c) of the question such as smoke detectors but few explained how an element with a short half-life could be used in medicine where it can be injected into the body to detect illness.

Question 3.9: *A steel cylinder of 225 mm diameter and 1.75 m length, contains air at a pressure of 200 bar. If its temperature changes from 30ºC to 430ºC, what will be the new pressure allowing for the expansion of the cylinder?(Coefficient of Linear Expansion of steel = 0.000012/ºC)*

Only a few achieved full marks for this question, but these and many other candidates had an excellent knowledge of this subject.

For some candidates the use of incorrect formula lost them valuable marks and for revision purposes I now include the following answers:

1) The volume of the cylinder = $0.0696m^3$
2) Expansion of the cylinder = $0.001m^3$
3) Expanded volume of cylinder = $0.0696 + 0.001 + 0.0706m^3$
4) The new pressure allowing for the expansion of the cylinder will be 457.5 bar

Question 3.10: *a) Define: (i) work, (ii) power, (iii) brake power, (iv) water power, (v) pump efficiency; b) What is the water power of a pump delivering 2000 litres of water a minute at a pressure of 5 bar, and; c) What will be the brake power required to drive the pump where the efficiency is 80%*

This was a very popular question and generally well answered. Candidates did however drop the occasional mark by incorrectly transposing the formula or attribute units to the final answer.

If a question asks you to 'define' this is a request for a short concise statement of the specific meaning of a term or word or in 'scientific jargon' a mathematical formula. I have added this point as candidates did labour some of their definitions.

Paper 4 - Management and Administration

Question 4.1: *Explain the factors that need to be considered when forecasting the long-term aims and objectives of a large organisation, such as a fire service.*

The important words within this question were factors and forecasting. All too many candidates appeared to miss the point and wasted time and effort explaining the process behind setting aims and objectives.

Well-prepared candidates mentioned items such as:

1) Staffing needs
2) Budget constraints

3) Population changes and urbane development

In addition to these points above, new developments in IT and climate change influences could have been explained.

This was a case of reading the question carefully and taking the time to set out the answer in a strategic pattern.

Question 4.2: *As a manager you are asked to speak to a course consisting of newly appointed supervisors to explain how to plan towards an objective. List and discuss the principles that you would cover to create a plan in your organisation.*

It was clear to the marker that too many candidates had failed to adequately prepare themselves for this style of question, candidates appeared to have read and not understood the type of answer that was required. The model answer included such points as:

1) The purpose of the plan must be determined; goals to be achieved must be clearly defined.
2) Plans must be flexible and allow for modification.
3) Standards to be achieved by the plans must be set out and the performance monitored.

Question 4.3: *Describe the risks associated with delegation and how you would minimise them.*

'John Adair' *Training for Leadership* explains these principles, but unfortunately the concepts were not understood by the majority who attempted this question and, therefore, marks were all too frequently lost!

Some candidates directed their answers too far down the lines of delegation by rank, structure, training etc. Read and understand the question, structure your answer logically, this is the advice often is not adhered to by candidates.

Question 4.4: *As a manager you may need to counsel a member of your staff to help them solve a problem. Describe the points you would consider when preparing for such a counselling interview.*

At the level of management associated with this examination, this question was a gift. Marks were available for a logical application of caring managerial approach, assistance and advice, preparation and planning of the interview and careful consideration of both individual and the organisation implications. Candidates failed to understand the requirements of the question, if they had their answers would have included the following which have been extracted from the model answer:

1) Do you know or suspect what the problem is.
2) Have you allowed plenty of time for the interview.
3) Does your staff member know how much time is available for the interview with you.

Question 4.5: *Explain why budgetary controls are essential in a Public Service Department*

The question was clear and concise but candidates failed to explain with any clear understanding any issues other than budget contents, which unfortunately was not asked for.

Budgetary controls are an essential management tool to study the performance of the service and its various departments. They would highlight any variations that become evident and can be analysed to ascertain any favourable or unfavourable developments.

Candidates must prepare themselves for this type of management question, as it will always remain topical and a primary function of any organisations control mechanisms.

Question 4.6: *Outline safety and environmental considerations, which should receive attention when organising realistic practical firefighting training.*

This understandably was a popular question. Generally candidates had read and understood the requirements of the question and had answered them with a degree of confidence.

Question 4.7: *'Functions of fire and other emergency services under a single level of management result in a number of resource savings and provide benefits to the public'. In support of this statement outline the potential savings and benefits.*

Generally most candidates answered the question well and attracted reasonable marks. However, approximately 10% of candidates appeared to completely misunderstand the question, their texts describe general fire service management related issues and attracted, therefore, no marks.

It is also important to remember that if a question asks for the benefits of whatever system is being investigated, then submitted scripts must reflect a positive approach and this was another area where candidates lost marks.

Question 4.8: *Health Education can make an important contribution to occupational health and safety. Explain the benefits to employers and employees.*

This unfortunately was one of those questions that was obviously read but not understood, with the subsequent award of poor overall scores.

Candidates became confused with what was being asked for, asked what they perceived and some quite detailed scripts were received which examined Health monitoring and the Health and Safety of further programmes.

Obvious benefits that were overlooked by the majority were:

1) Reduced accident rates.
2) Absenteeism reduction.
3) Improved morale of employees.
4) Increased production and cost advantages to the organisation.

To mention just a few taken from the model answer. This area of health and safety education/training needs a higher level of preparation generally by most candidates.

Question 4.9: *Summarise the skills and knowledge which can contribute to how managers convert their decisions into effective action and maintain standards and morale in the process.*

Candidates seemed to experience difficulty in interpreting exactly what the question was asking for. The highest scores were achieved by candidates who realised what the question demanded was the skills and knowledge needed to implement decisions, and not those required to make the decisions in the first place.

Question 4.10: *As a manager you have responsibility for undertaking safety risk assessments in premises under your control. a) Define: (i) Hazard, (ii) Risk and; b) List and briefly describe the principal steps in carrying out risk assessments.*

Candidates demonstrated a good understanding of a) (i) hazard and (ii) risk. Their definitions for revision are:

1) Hazard - something with the potential to cause harm
2) Risk - the chance, high or low, of that harm occurring and the degree of severity of harm if it did occur.

For most candidates that is where the understanding finished. Part b) of the question was poorly answered. Candidates mentioned Risk Assessments, Tactical Operational Fire Plan answers that were not asked for. Briefly Part b) was looking for:

1) Identification of Hazards
2) Decide who might be harmed and why
3) Evaluate the risks
4) Record the findings, and
5) Review and assessment.